

**MOUNTAINTOP MINING/VALLEY FILL
TECHNICAL STUDIES**

STUDY OF FUGITIVE DUST AND FUMES

by

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ABSTRACT

We find no indication that there are any significant health risks due to exposure when no personnel are in close proximity to the blast zone. This is the standard procedure for safety purposes anyway. A common safety zone for large blasts from which all personnel are excluded is a 2,000-ft radius. As blasts grow smaller, the required safety zone also shrinks. But even within 1,000 feet, measurements of adverse levels are infrequent and of short duration.

This investigation is concerned with fugitive dust and fumes, meaning that which escapes the confines of the mining property. This investigation indicates that these emissions present no potential health problem for the following reasons.

- C No event produced any harmful levels of any duration at distances exceeding 1,000 feet, except one measurement of 3.6 ppm NO₂ at 1251 feet.
- C This measurement, and all others were of very short duration.
- C Fugitive emissions are those that leave the property; if the property boundary is closer than 2,000 feet, persons within this area are evacuated.

Quality of life issues other than health, that is the enjoyment of life and the potential of reducing that enjoyment, is harder to define because of its very subjective nature. Photographs of dust settling out of blasting clouds do not show significant deposition beyond 1000 feet. When viewed alongside the fact that four-wheel drive vehicles can produce 75 pounds of fugitive dust per mile traveled on a dirt road (Hesketh, 1983), and that many county roads in the vicinity of a surface mine are unpaved, blasting would appear to be an unlikely source of significant dust at off-site locations.

Dust and fume emissions from 11 blasting events at three mines were measured, 10 of which were useable. Both respirable and non-respirable dust was measured, as well as nitrogen dioxide (NO₂), nitric oxide (NO), carbon monoxide (CO), and ammonia (NH₃). Nitrogen dioxide, total dust, and respirable dust were measured at 10 points for each event; the remaining fumes were measured at only one. At four events, settled dust at the monitoring stations was caught on filter paper and photographed.

Results are consistent, but the statistical correlations are not all good. The suspected primary reason for poor correlations is the inability to account for wind velocity and direction across the measurement sites close to ground level. Surprisingly, the best average correlation ($r = 0.86$) was an inverse relationship between NO₂ and humidity. The CO and NH₃ highs were also a surprise. Topographical constraints, although expected, were worse than expected. Topographical constraints were such that all sites were within 1900 feet, with an average distance of 943 feet. This was actually a fortuitous turn of events because of the very low levels of anything that were detectable as the stations approached 2000 feet.

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The Office of Surface Mining supported a trip for the primary investigator to Gillette, Wyoming, where a conference was held on blasting fumes. This trip provided a substantial insight on explosive fumes that would have been available in no other way. One of the cooperating companies also underwrote a trip to talk to a number of experts investigating explosive fume emissions, and this also was a great aid in performing this work.

Rich Mainaro, James Roland, Steve Page, and John Organiscak of the NIOSH research facility in Bruceton, Pennsylvania, provided us with substantial background information on the measurement of fumes and dusts. This information enabled us to avoid a number of instrumentation mistakes we might have otherwise made, and pointed the most reasonable directions for us to proceed, given budget and time constraints.

In particular, the authors would like to express thanks to Ken Eltschlager who made his substantial expertise and experience available to us at all times, and also reviewed the rough draft of this manuscript, capturing a number of typographical and referential errors for us in the process.

Above all, credit must be given to the cooperating mining companies who granted us free access to their facilities and operations and provided us with information. They did so in a spirit of cooperation and in agreement that this information was worth pursuing and potentially useful, regardless of the outcomes. Cooperation such as this is what enables us to reach beyond theory and into practicality, which does not always agree with the theoretical. Our special thanks goes to these companies who were willing to take risks to advance the state of knowledge about mining and blasting.

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